BDS - an Approach for Real Diagnostic Frontloading

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- Introduction: Diagnostic Dimensions in Service
- Bosch Diagnostic Solution – the Big Picture
- The BDS Modules – Development and Deployment
- The Testing Language Concept
- Summary

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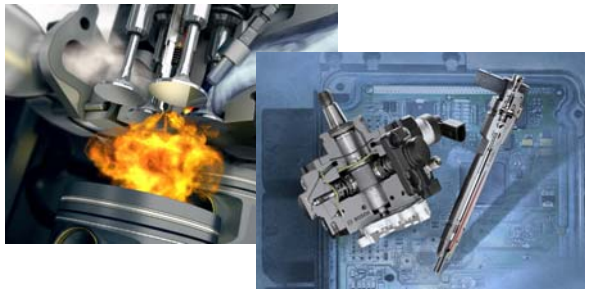
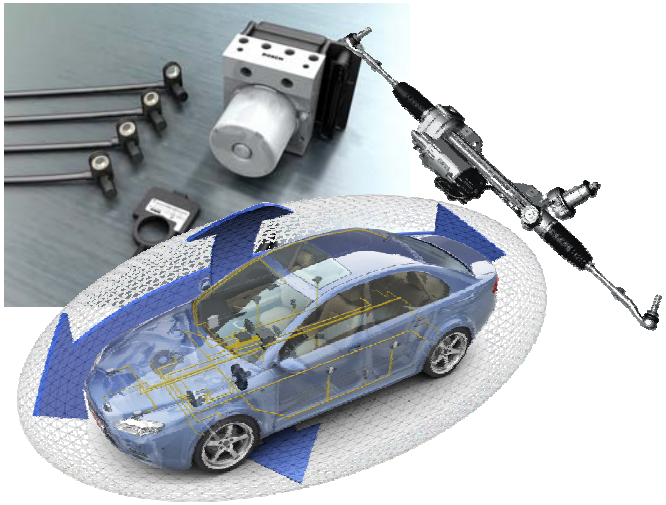
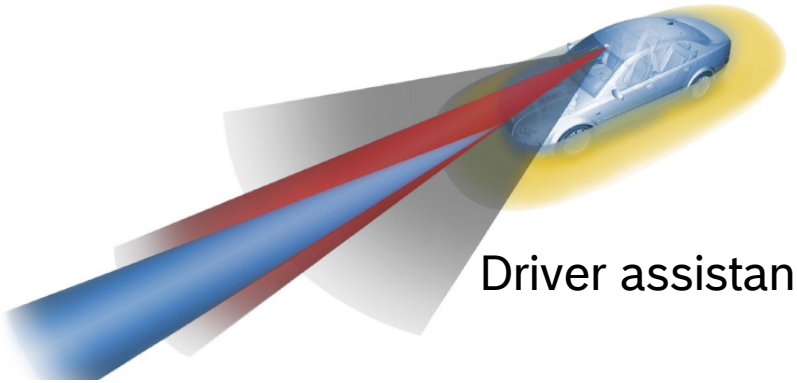
New Systems require new Diagnostic Approaches

Common Rail



Integrated Chassis Control Systems





Driver assistance

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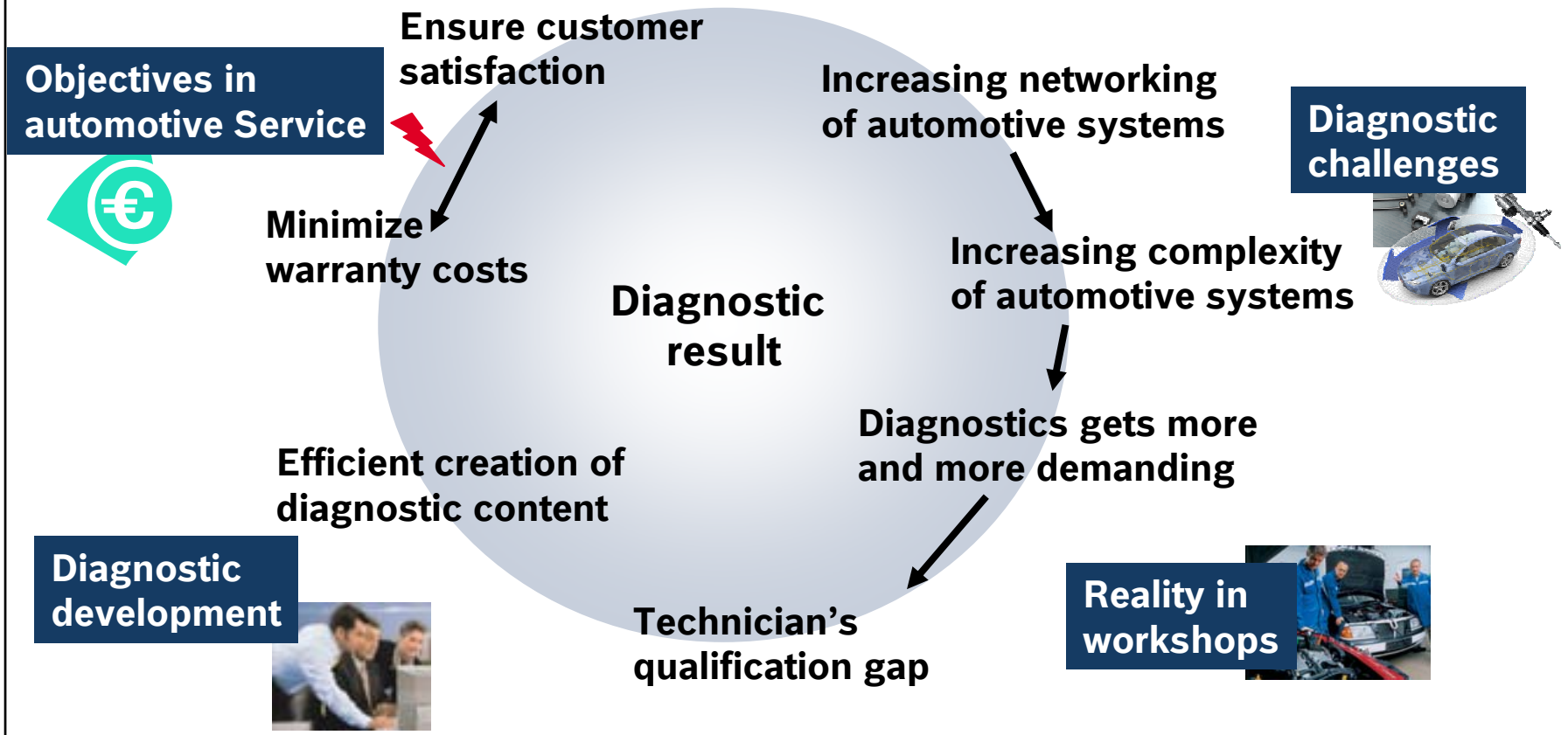
Introduction: Diagnostic Dimensions in Service



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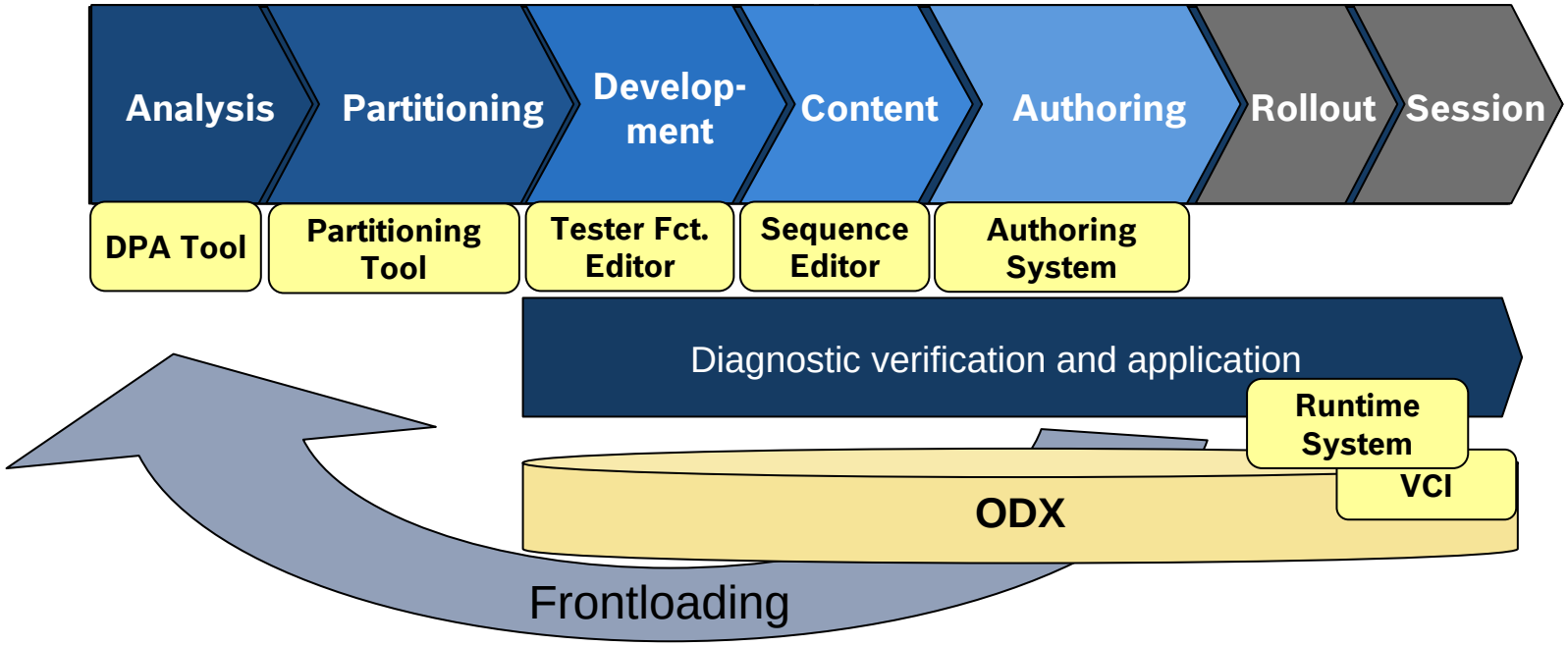
Approach

Diagnostic frontloading as key approach to cope with the diagnostic challenges:

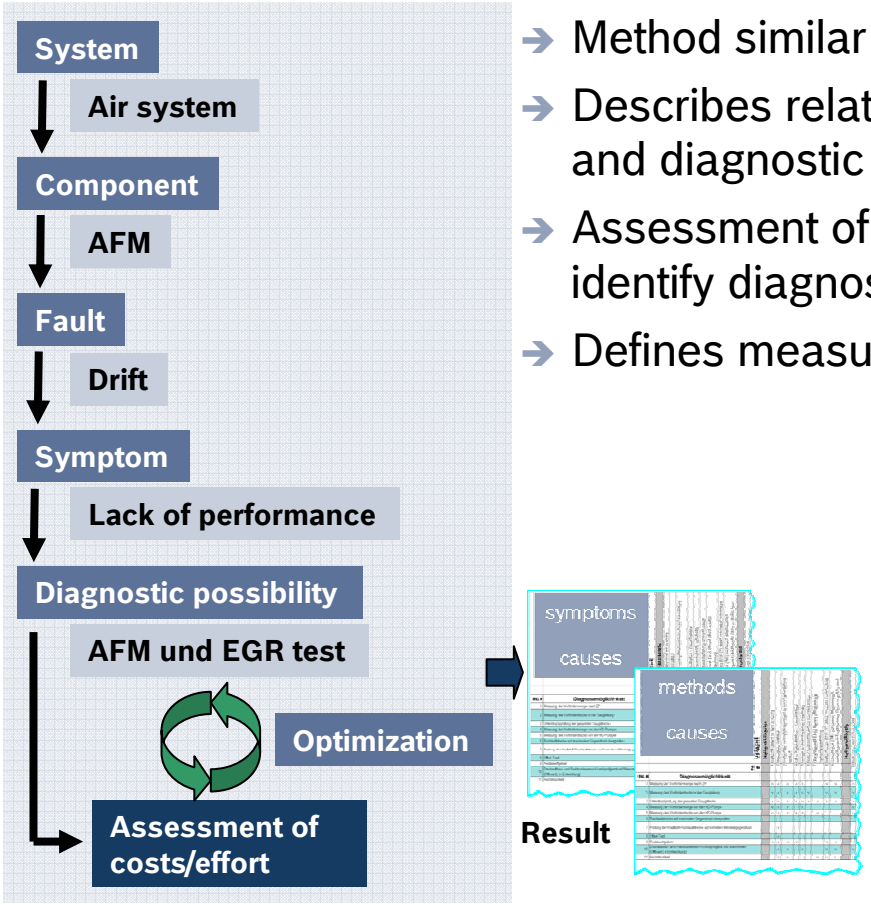
Bring Engineer's Know-How to Workshops



Core Issues of BDS

- BDS is an **Integrated Diagnostic Solution** for development, production and service
- BDS comprises **Diagnostic Development System** and **Diagnostic Deployment System**
- **Modularity** allows integration of existing diagnostic tools
- BDS supports **Diagnostic Frontloading** by
  - Diagnostic analysis and design
  - SW-development for diagnostic offboard function on tester
- **Simultaneous Engineering** of on- and offboard diagnostics

DPA-Tool: Diagnostic Possibility Analysis-Tool



Result

- Method similar to FMEA
- Describes relation between faults, symptoms and diagnostic possibilities
- Assessment of diagnostic coverage and identify diagnostic gaps
- Defines measures to close diagnostic gaps

Benefits:

- Approach to real frontloading
- Systematic and early identification of diagnostic gaps
- Basis for development of diagnostic functions and sequences
- Entry point for feedback from workshop

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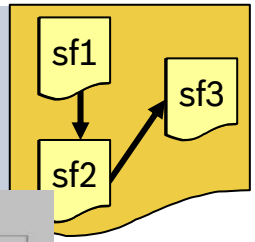
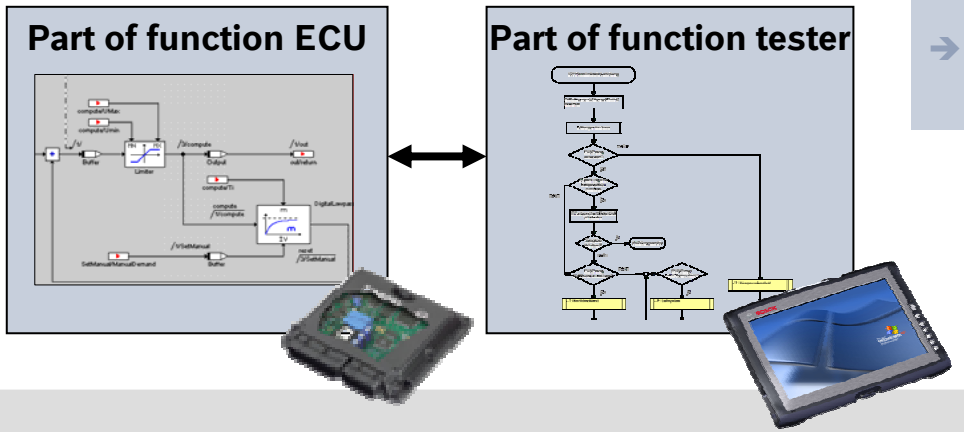
Partitioning of Diagnostic Functions on ECU and Tester

Graphical representation of diagnostic function



Diagnostic function
(sf: sub-functions)



Benefits:

- Reduces ECU resources
- Visualization and methodical support of partitioning task
- Optimization of partitioning of diagnostic functionality on-/offboard
- Partitioning strategy can be changed with minimal effort
- Traceability of partitioning decision
- Improved specification of diagnostic functions

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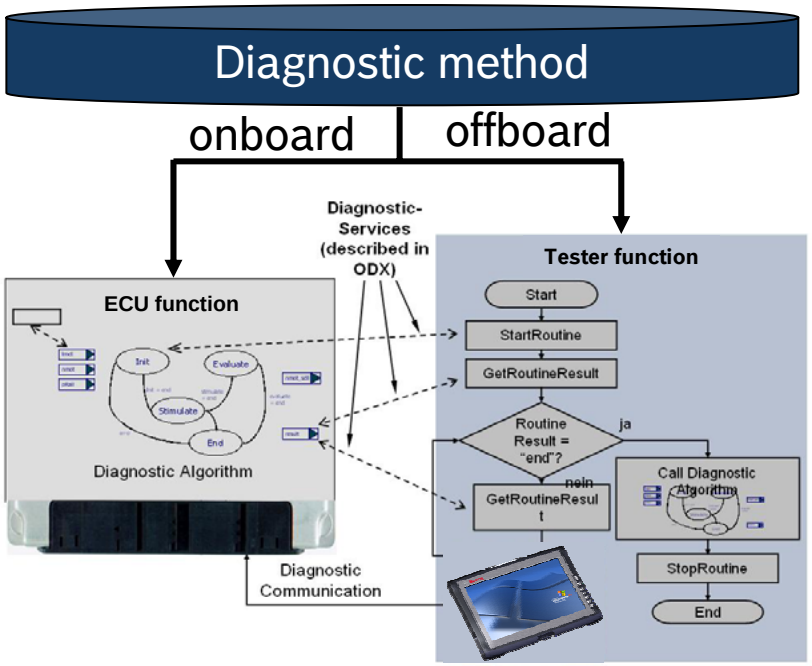
Development of Tester Functions



Part of diagnostic function on ECU

Part of diagnostic function on tester

Benefits:

- Development of tester functions simultaneously to ECU-software
  - ⇨ Frontloading of diagnostic content generation
- Rapid prototyping of diagnostic functions for service tester
- Automatic code generation enables application of tester function on different platforms

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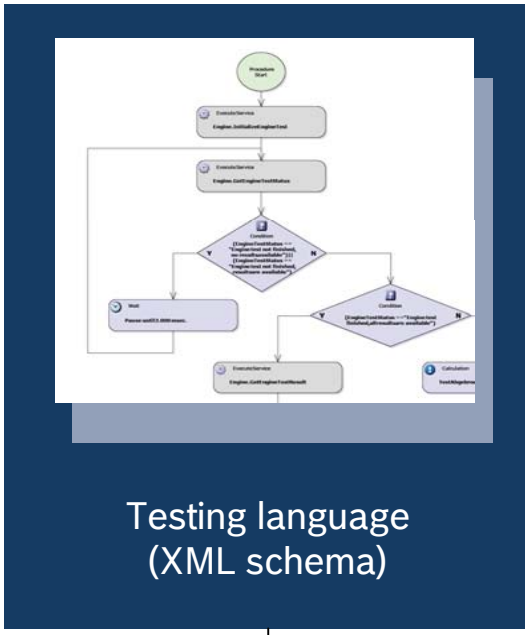
Diagnostic Sequences



- Graphical development of sequential logic:
  - Execution of services
  - Logic operators
  - Calling of external functions
  - Mapping to ODX elements
  - Display functions
- Automatic generation of runtime code
- Testing language for standardized description of sequences

Benefit of Frontloading in Diagnostic Development

- Closer Integration of diagnostics in development, production, service
  ⇨ **Higher diagnostic quality** in production and service
- Analysis of diagnostic coverage and requirements
  ⇨ **Ensure** diagnostic quality
- Flexible onboard/offboard-partitioning of diagnostic functionality
  ⇨ **Easy adaptable** to technological and economical constraints
- Development and prototyping of offboard diagnostic functionality synchronously to ECU functionality
  ⇨ **Efficiency** through
  - tool support
  - simultaneous engineering
  - re-use

Is ODX Really Sufficient?

- ODX enables continuous handling, exchange and usage of diagnostic data…

  … **but only of diagnostic data**

- Need for enhancement:

  Standardized description of diagnostic logic

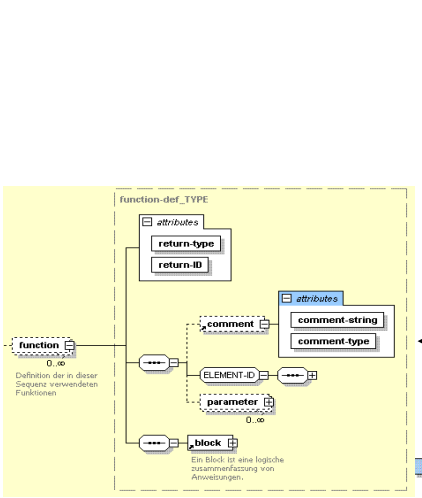
  - Diagnostic sequences
  - Guided troubleshooting
  - Coding and learning sequences
  - Flash sequences

  ⇨ **Standardized testing language as further element of diagnostic standards**

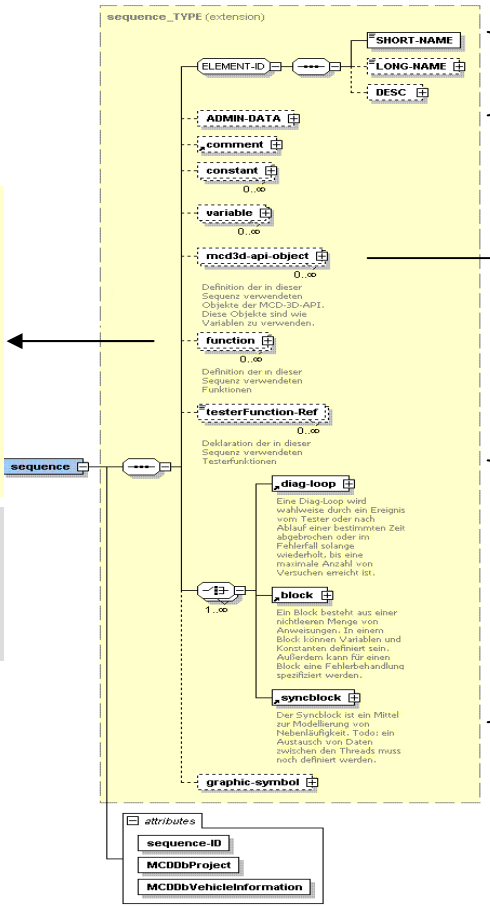
What is a Testing Language good for?

- **Target platform independent** format to describe diagnostic sequences
- **Exchange** of diagnostic sequences **across the different domains** development, production and service
- **Exchange** of diagnostic sequences **between supplier and OEM** as well as between different OEMs
- **Re-use** of diagnostic sequences

Outline of a Diagnostic Testing Language



Utilized functions inside logic blocks building up the sequence

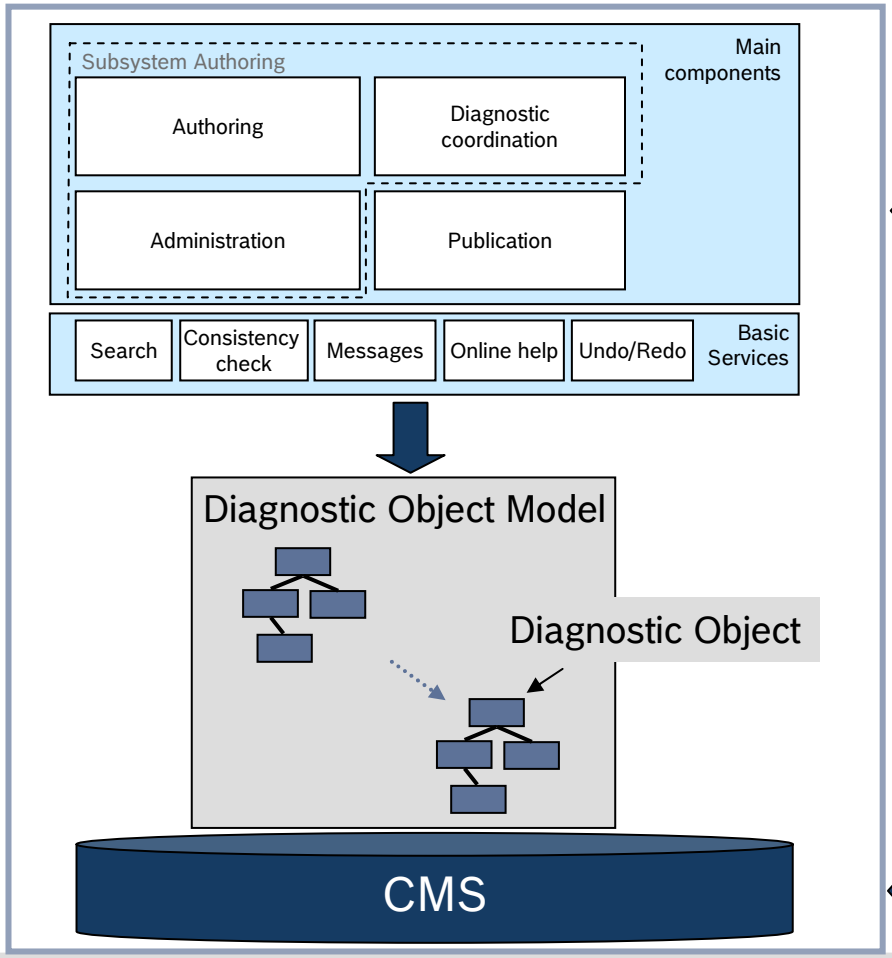


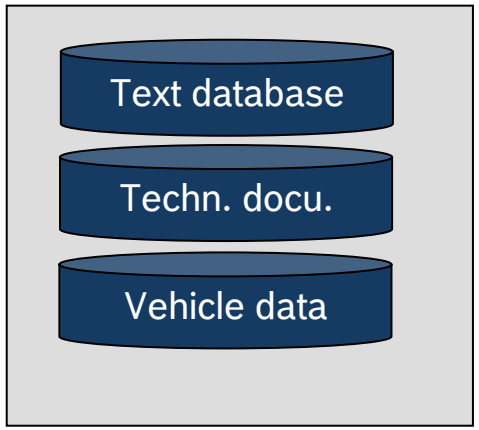
Identifier for Diagnostic Sequence

Linkage to 3D-API (definition of communication objects)

Control functions for execution of logic blocks

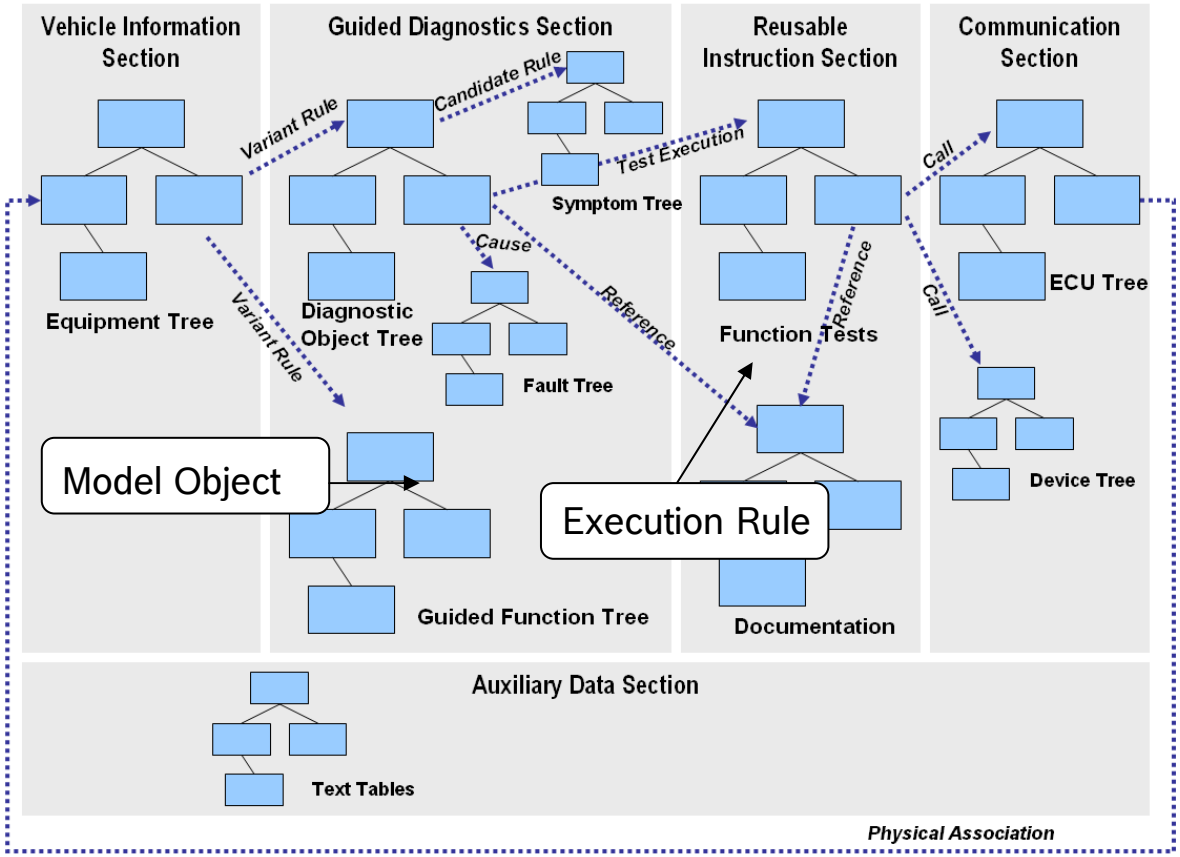
Authoring System





Provision of diagnostic content for all customer‘s diagnostics testers

Diagnostic Object Model



- Each Model Object is related to an execution rule.
- Execution rules are defined as sequences, which call diagnostic sequences.
- All kind of sequences are defined using a testing language.

One Model to cover all diagnostic use cases!

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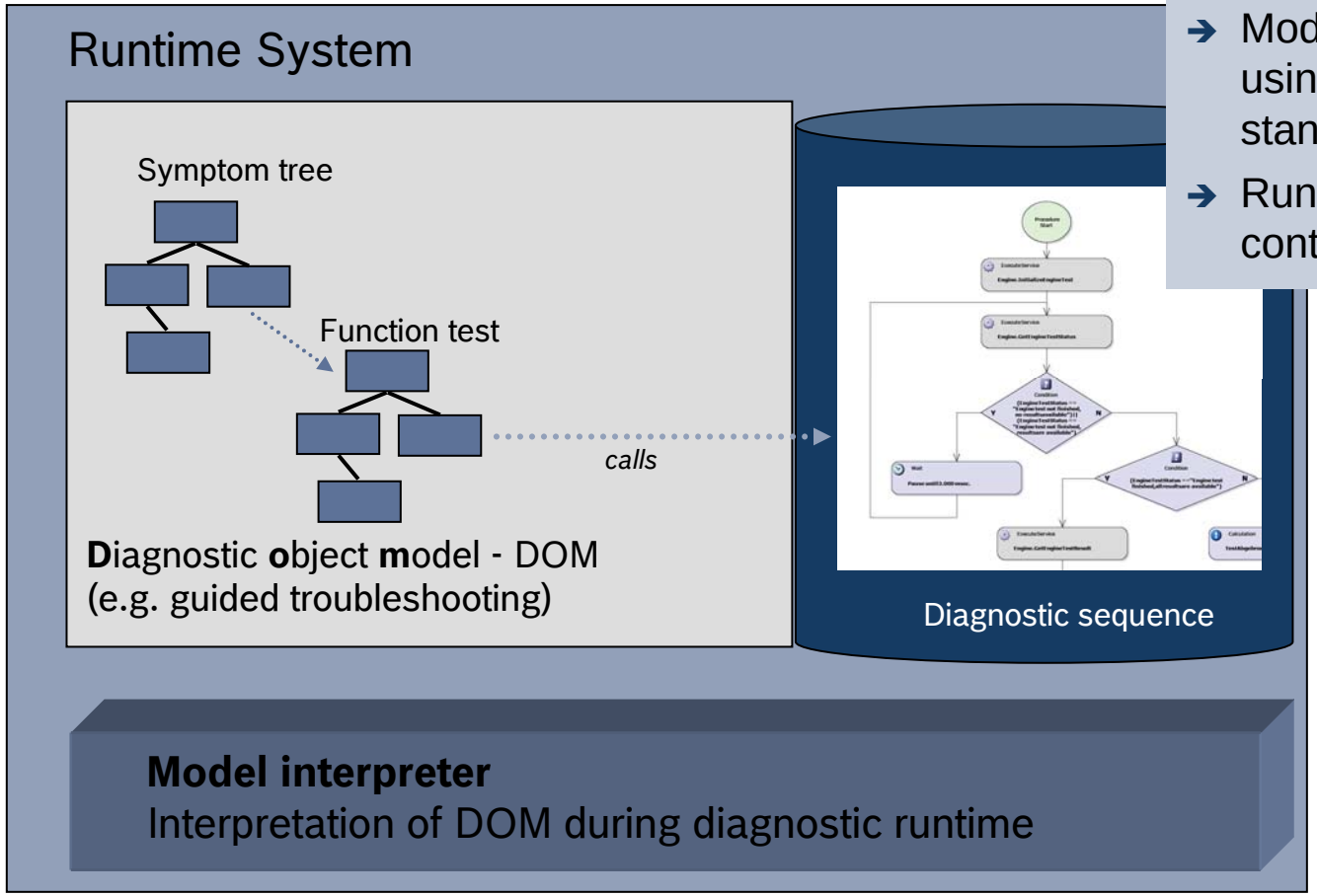
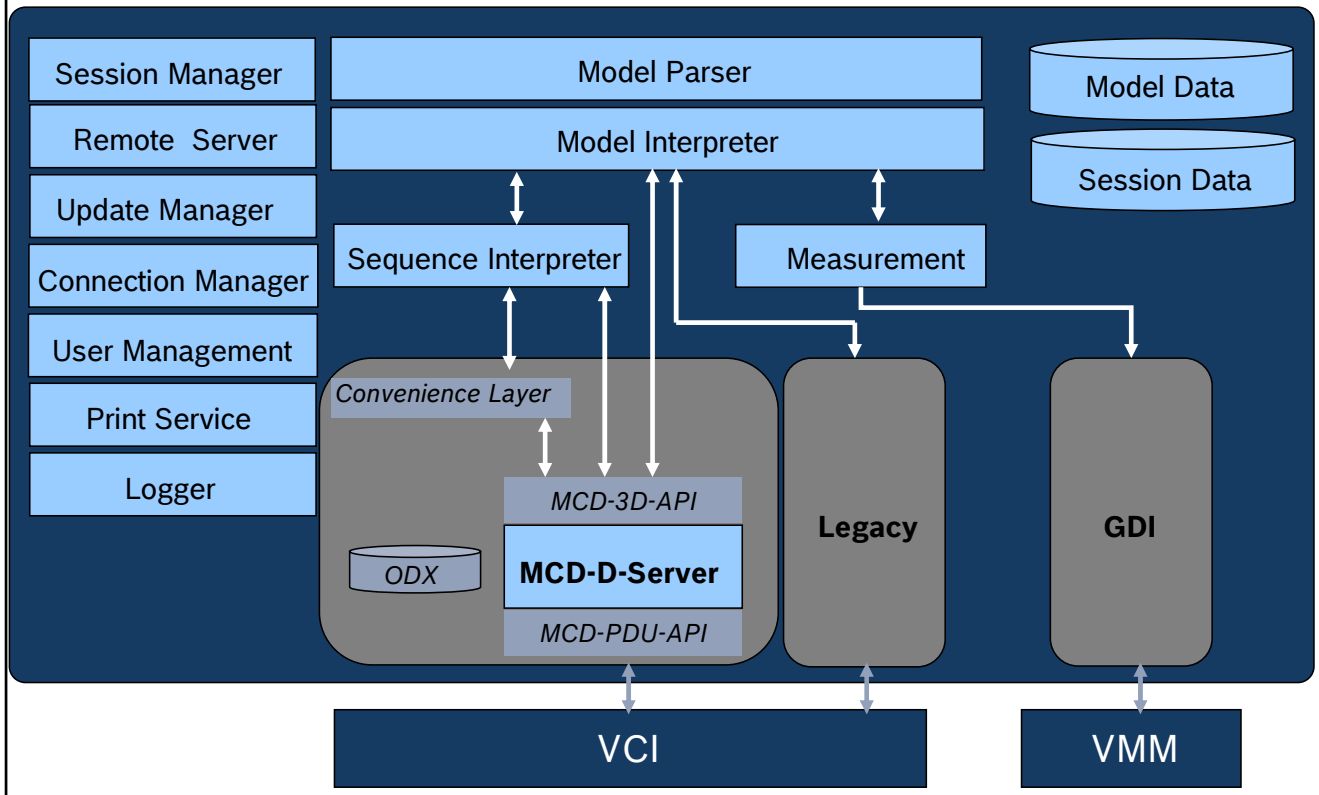
Model-based Execution of Diagnostics



- Modular runtime system using state-of-the-art standards
- Runtime behaviour is controlled by models

Runtime System



- Controlled by exchangeable DOM
- Integration of external measurement devices
- Architecture according to ASAM standards

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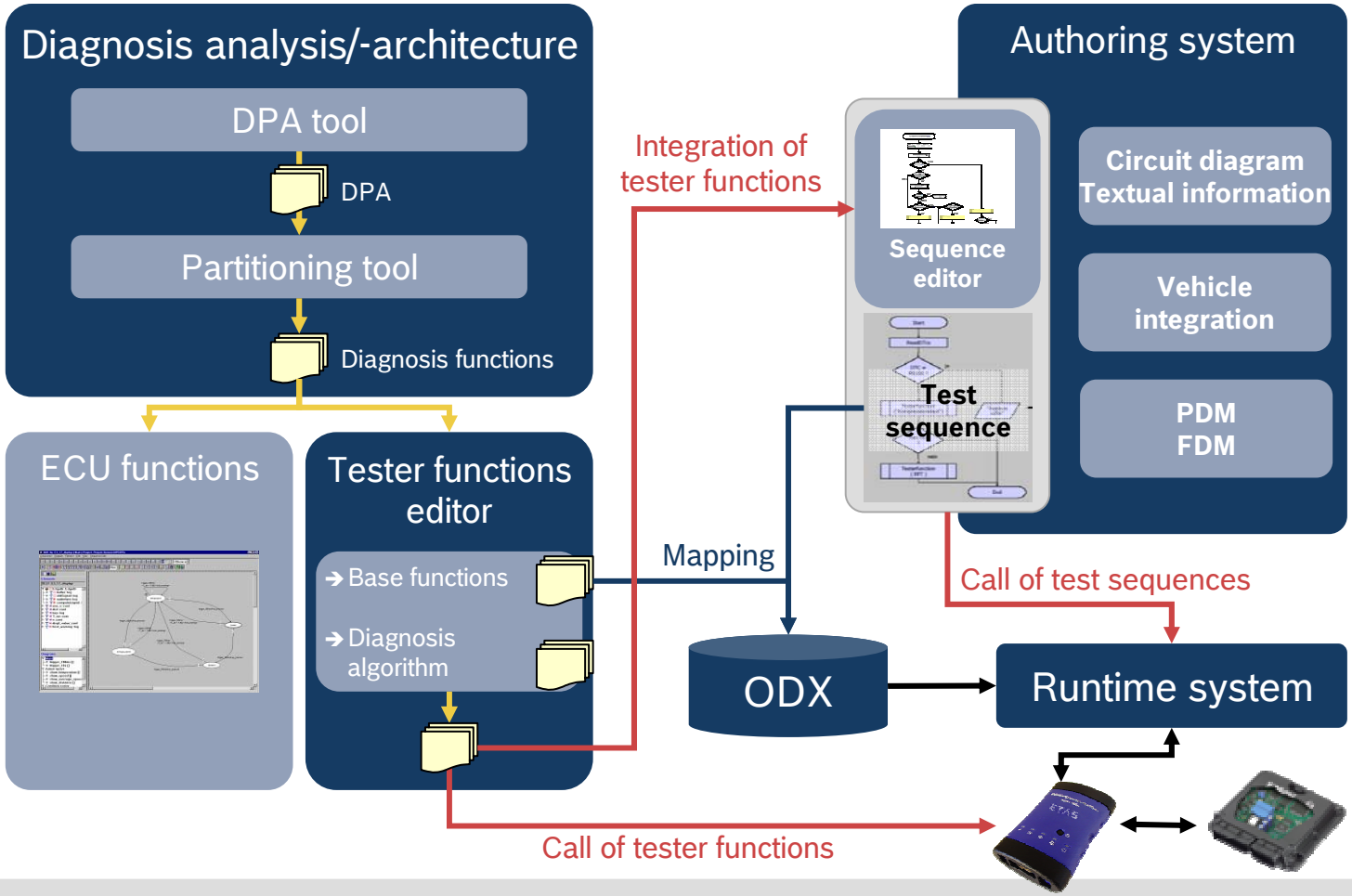
How Does It All Work Together?



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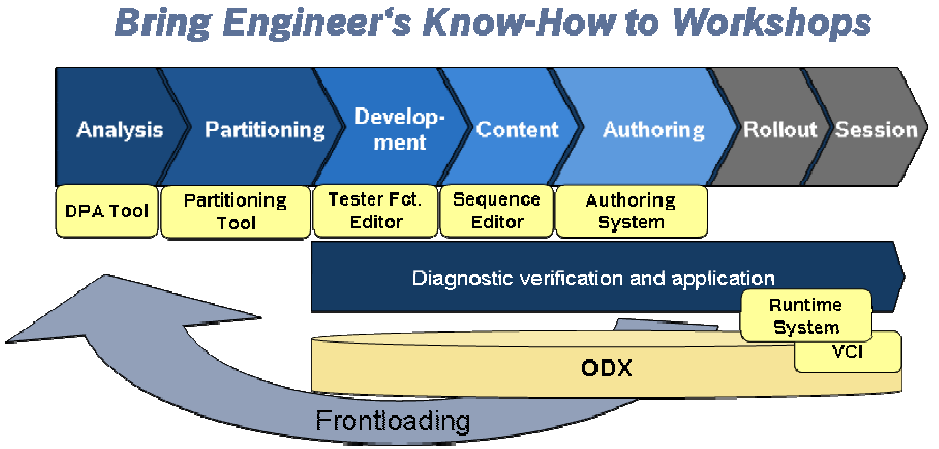
Summary

- **Cover diagnostic tasks from development to service**
- **Minimized authoring effort (time & cost)**
  - Support of real **frontloading** by diagnostic analysis
  - Easy **adaptation** to technical and economic constraints by flexible on-/offboard partitioning of diagnostic functionality
  - **Seamless data integration** (ODX, Testing Language)
  - **Parameterization and Configuration** of runtime system instead of individual programming
- **Effective and efficient diagnostics in workshops (time, quality, cost)**
  - **Scalability** of workshop user support: from beginner to expert
  - **Context-related adaptation** of troubleshooting
  - **Flexible interfacing** to user

Thank you for your attention.



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